



TECHNICAL NOTE

Technical Note 46

U.S. DEPARTMENT OF THE INTERIOR – BUREAU OF LAND MANAGEMENT

FLEXIBLE HOSE INSPECTION AND FAILURE

(When to Replace Flexible Hose)

In the design and manufacture of equipment, both in the heavy-duty classification as well as in the lighter equipment, every effort is made to provide flexible hose materials of the finest quality to assure continued reliable service life. In addition, careful attention is given to the routing and attaching of hoses to assure protection against hose damage either from excessive heat, sharp edges or possible points of contact which would cut or wear through the hose.

In order to assure continued trouble-free service where flexible hoses are concerned, periodic inspections should be given to the hoses so that hose replacement can be scheduled when damage or hose deterioration is found.

It must be recognized that all hose materials, while of such quality to remain serviceable over long periods, are still subject to eventual deterioration or possible damage and should be checked for replacement, particularly after the equipment accumulates considerable hours or mileage or is a piece of equipment that is subjected to severe service such as off-highway use or is operated in extreme temperature conditions.

To guide the serviceman in performing hose inspection, we are providing the following outline and recommendations which will serve as a suggested procedure. The variety of uses and arrangements of hose application prevents touching upon all situations; however, the importance of a general inspection, performed carefully and at adequate intervals is evident. The hose usage is divided into specific application for ready reference.

AIR BRAKE LINES OR HOSES

Air brake lines should be inspected at intervals of 100,000 miles of operation or every two years. In all cases the hose or line must be replaced where a deficiency is found.

Heavy deposits of foreign material, dirt, oil sludge or hose deterioration as a result of materials entering the system through the air intake at the air compressor would indicate that a further examination of the remaining hoses should be made.

Inspect for:

Abrasion: Abrasion, or chafing, occurs when the hose cover rubs against another object. Therefore, it is important that the hose be installed in such a manner that it does not come in contact with adjacent objects. Of particular importance in the prevention of abrasion is adequate clamping to prevent movement of the hose.

Pinched Condition: A reduction of the hose O.D. caused by applying clamps too tightly or routing between vehicle structures. See chart for hose O.D. dimensions. Fig. 1.

Dash Size	Hose I.D. (Nominal)	Hose O.D. (Nominal)	Min. Bend Radius (In.)
-4	.188	.491	.75
-5	.250	.554	1.00
-6	.313	.617	1.25
-8	.406	.737	1.75
-10	.500	.831	2.25
-12	.625	.956	2.75
-16	.875	1.206	3.50
-20	1.125	1.487	4.50

Closed Diameter: Caused by sharp bend in hose. Short hose length. Wrong radius. See chart. Fig. 1.

The Minimum Bend Radius is measured from the inside of the bend. Fig. 1.

Minimum Bend Radius: The minimum bend radius is a radius established by the hose coupler as the tightest radius to which the hose may be bent. This radius is important, as the hose may kink or free flow through the line may be restricted if the minimum bend radius is exceeded.

Cuts, Punctures: Caused by resting hose against sharp edges. Cut by stone, etc.

Cracked Appearance: Excessive heat or excessive flexing will cause cracks to appear.

Leaking at Fittings: Tensile loading on hose. Loose fittings. Improper fitting assembly at hose end.

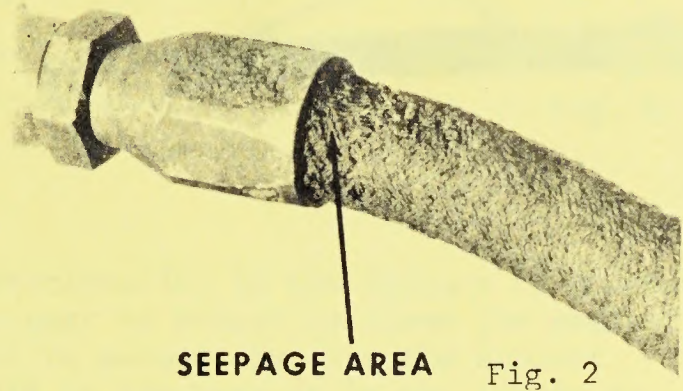
Leaking at Hose: Inspect for leakage using soap and water solution along length of hose and at fittings with full system pressure applied.

HYDRAULIC SYSTEM LINES

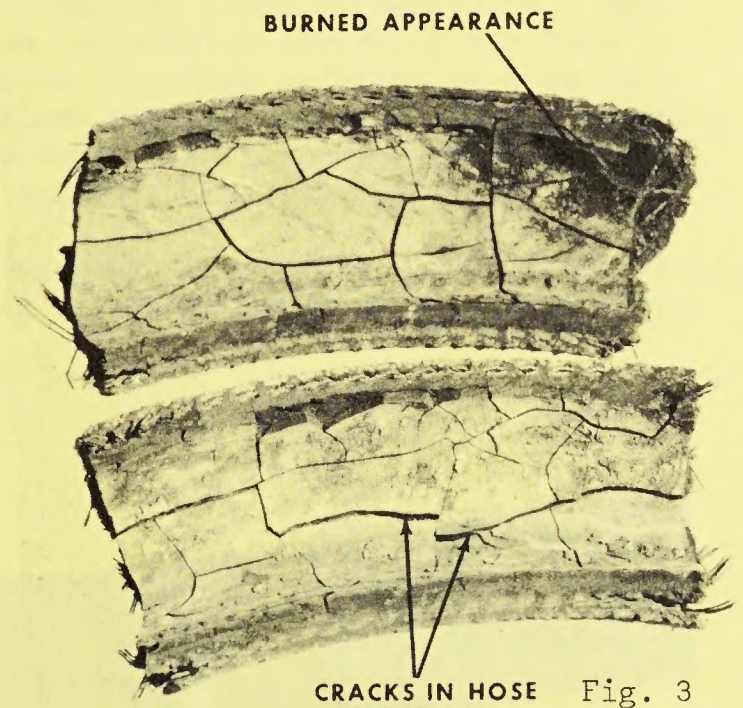
(Brakes, Power Steering, Cab Lift Systems, Engine Oil Lines, Etc.)

Flexible lines or hoses used in systems which operate under various levels of pressure in controlling trucks or vehicles should be subjected to regular detailed inspection based upon vehicle mileage or type of service. Hoses should be considered for replacement after 100,000 miles of service or every two years. Where over-the-road vehicles are accumulating high mileage in relatively short periods, hose replacement may not be required at the 100,000 mile interval. Inspect as follows:

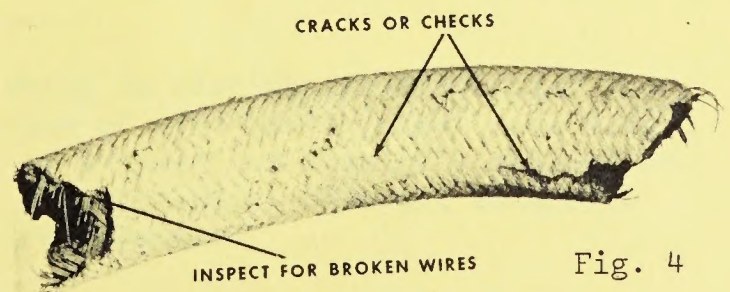
Fluid Leaks: Unless fluid leaking can be remedied by tightening a fitting at the hose end, the hose should be replaced. Slight wet spots or seepage in the hose length or at the fitting joints indicates possible early failure. Always replace hoses in this condition. Fig. 2.



Cracked or Flaked Hose Surface: Hoses in this condition should be replaced; however, determine that the condition is a result of deterioration of the hose material itself rather than in the paint on the hose. Hoses subjected to severe heat either internally or externally could show cracks or appear burned. Good service practice is to remove and cut open a hose section. Fig. 3



Brittle or Stiff: Old, deteriorated, due for replacement. Excessive heat. Subjected to chemicals not compatible with hose materials. Fig. 4.



To further determine the need for hose replacement, it is recommended that a hose section be removed from the truck to serve as a test or check for hose condition. This hose should be flexed 180° to the minimum bend radius, returned to the straight position and then rotated 180° (so as to bend in the opposite direction) and the procedure repeated. Examine the hose for cracks in the hose cover or other damage caused by this check. This same hose should be dissected (cut open to expose the hose sections and wires) and examined for broken wires or evidence of hose deterioration.

Soft Peeling Away, Blistered:
Overheated (internally or externally), exposed to chemicals not compatible with hose material.
Fig. 5.

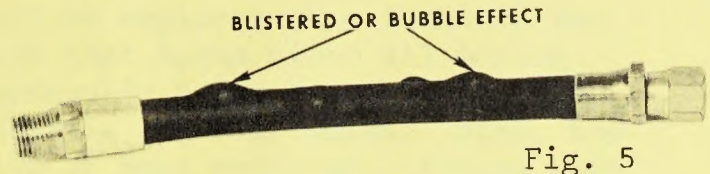


Fig. 5

IMPORTANT:

A major cause of flexible hose deterioration is the failure to protect hoses from excessive heat. Hoses must be routed to clear the engine exhaust system and the hose should be secured by adequate support clips so that over the service life of the hose it is not likely to sag, reducing clearance between hot exhaust pipes or manifolds. Upon the occasion of inspection, examine the vehicle carefully for this situation. Check at the exhaust pipe discharge location to make certain that hot exhaust gas is not blown against hoses or lines. Vehicles are designed and manufactured to account for the proper shielding and routing of hoses to guard against excessive heat.

Cuts, Abrasion, Chafing: Contacting rough or sharp surface, unprotected from flying debris, rubbing vehicle structure, contacting moving parts, supported by clipping.

Closed Hose Diameter, Pinched:
Routed between vehicle structures. Sharp bend. Twisted, open metal strands, frayed areas. Clamped shut by clips. Fig. 6.

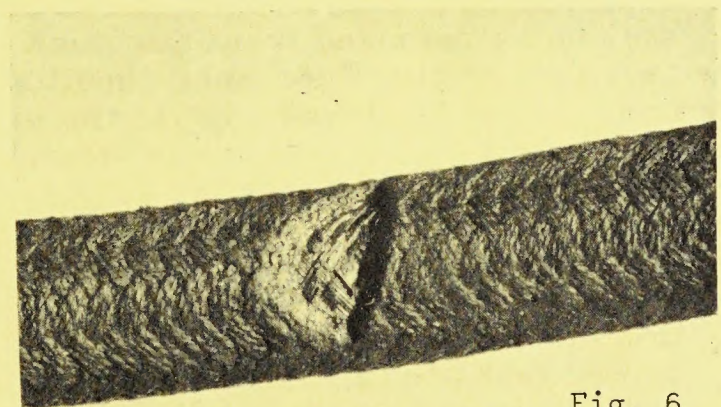


Fig. 6

Color Change: Hose deterioration which is distinguished by color changes may be caused by contamination of wire braid (under hose cover) or contamination of the hose cover as a result of chemicals spilled on the hose. Chemicals can be washed from the hose; however, extensive chemical damage would require hose replacement.

GENERAL

In general, where hoses are found to be in one or another of the mentioned conditions, the remedy is obvious. A regularly scheduled and periodic inspection could bring attention to the need for corrective measures so that complete failure can be avoided. The information herein will prove helpful when checking hose installations or making hose replacement.

As a rule, the hose routing and points of hose support or attachment to the vehicle should be re-established when hose replacement is made. Also, hose guards or covering should be replaced when found on the original installation. Make certain that hoses clear all moving parts--especially when replacing hydraulic brake flexible hoses at the front wheels and between the chassis and rear axles. Also, new hose should be of compatible quality of hose replaced. Always mate hoses--that is, air and air, hydraulic and hydraulic

Leaking hoses anywhere along their length, no matter how minor the leakage appears, represents a weak spot which could cause downtime, or worse, an injury.

One very important rule concerning hydraulic hoses is the 4:1 safety factor. You should always use hose which is rated for pressures four times higher than the normal operating pressure in the system. For example, if the system operating pressure is 2,500 PSI then hose with a 10,000 PSI burst pressure should be used. This is necessary to compensate for the tremendous surge pressures which occur in today's high performance hydraulic systems.

